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OPERATING COSTS OF A WELL-ESTABLISHED NEW YORK APPLE ORCHARD.[1]

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INTRODUCTION.

It is not primarily the purpose of this bulletin to present data which actually show the cost of operating a mature orchard, but rather to suggest a plan of cost accounting for orchard operations. This will be useful to fruit growers who wish to determine the cost of fruit production.

Probably in no branch of farming have greater recent advances been made than in fruit growing. The growing of the apple is one of the most highly specialized branches of agriculture. It is a business which requires scientific knowledge, skill, and the greatest care to make it a success. Many investors have entered the field, and many of the older growers are realizing profits. Thus spurred on by stories of fabulous returns, millions of trees have been set in the last decade. It is probably safe to say that few know the cost of growing this fruit. It is certain that there is a scarcity of accurate data published on this problem.

The method of cost accounting is discussed through the presentation of two years' data obtained by the Office of Farm Management through cooperation with Mr. H. E. Wellman, a progressive fruit grower in Orleans County, N. Y. Detailed records of all daily labor and financial transactions were kept, including complete inventories and accurate surveys of all crops, as well as all necessary information to determine not only the costs of the apple enterprise, but also the cost of the entire farm business. It should be carefully noted that the data presented in this bulletin are costs based on the annual expense factors incident to the maintenance and operation of a well-cared-for mature orchard. No attempt is made to establish a normal for the different items entering into the cost of growing

[1] Acknowledgment is due to Mr. J. S. Ball for aid in the compilation of the data presented and to Mr. H. E. Wellman, through whose cooperation this work was made possible.

Note.—This bulletin contains data on the cost of producing apples on a mature orchard operated in connection with a general farm in western New York. The information is applicable to all similar operations.

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apples over the entire country, for to do that would require a much more extended study.

No figures are available from which to determine the cost of planting and caring for this orchard up to the time it began to return

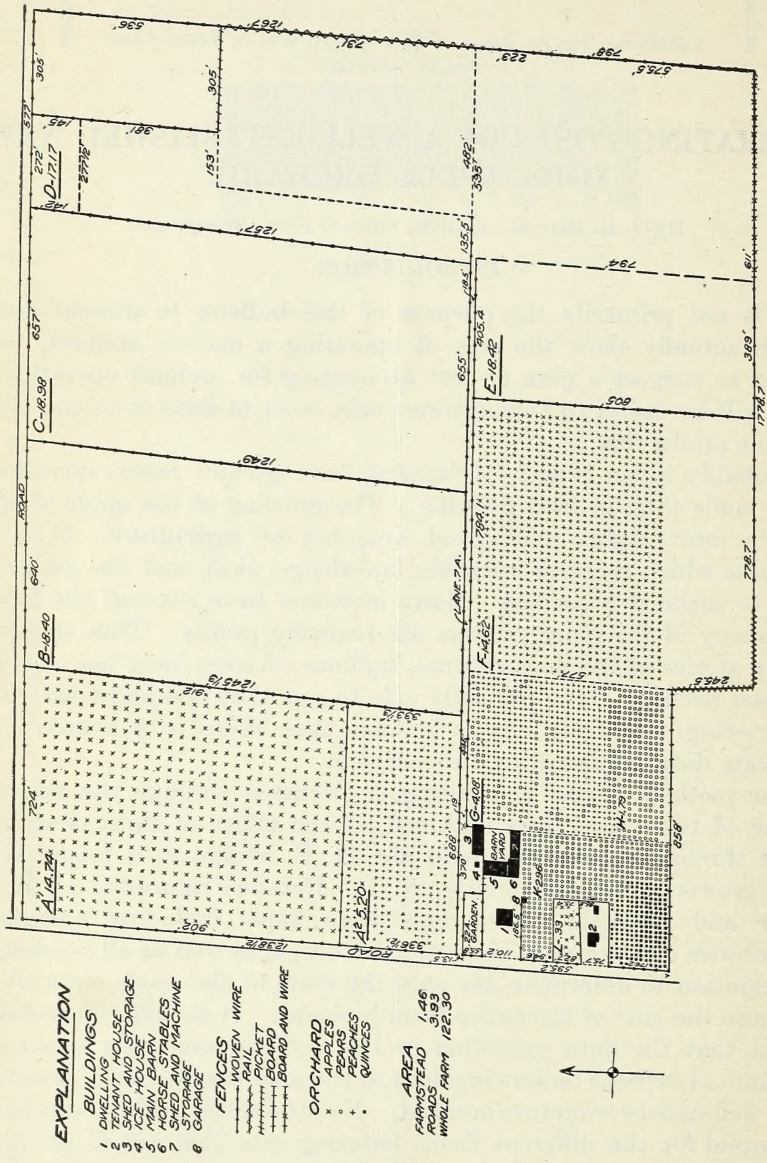

FIG. 1.—Diagram of the Wellman farm showing the arrangement of the fields and the location of the orchards.

profitable crops. No attempts have been made at estimating the profit or loss that may result from this area during the declining years of the orchard, and no loss factors incident to crop failure such as occur in the life of every orchard enterprise appear here. It

must be remembered that these records cover expense items only during two years of the life of the orchard and do not show the full cost of apple production, even in a region of high potential possibilities for this industry.

The farm under consideration is situated in the northeastern part of Orleans County, 1 mile south of Lake Ontario and 1½ miles from the shipping point.

The farm, a diagram of which is shown as figure 1, consists of 122.3 acres of tillable land, well drained. The soil varies from a medium clay loam to a stiff clay. Of this 122.3 acres, 39 acres, or approximately 37 per cent of the crop area, are in fruit.

Table I shows the relation of the fruit and general crops on the farm as a unit.

TABLE I.—*Summary of crop areas on the Wellman farm for 1911 and 1912.*

Crops.	Proportion of crop area in—			
	1911	1912	1911	1912
Orchard fruits:	*Acres.*	*Acres.*	*Per cent.*	*Per cent.*
Apples in bearing	14.74	14.74	14.1	14.1
Peaches in bearing	7.85	7.85	7.5	7.5
Pears in bearing	3.95	3.95	3.8	3.8
Quinces in bearing	.80	.80	.7	.7
Total bearing fruit	27.34	27.34	26.1	26.1
Apples and peaches, nonbearing	9.92	9.92	9.5	9.5
Apples, nonbearing	1.26	1.26	1.2	1.2
Quinces, nonbearing	4.70	.....	4.5	.....
Total nonbearing fruit	15.88	11.18	15.2	10.7
Total fruit	43.22	38.52	41.3	36.8
General farm crops:				
Beans	11.01	17.28	10.5	16.6
Wheat	18.04	18.95	17.3	18.0
Hay	19.00	18.98	18.1	18.1
Corn	4.70	4.67	4.5	4.5
Potatoes	.80	.83	.8	.8
Oats	7.90	5.47	7.5	5.2
Total general farm crops	61.45	66.18	58.7	63.2
Recapitulation:				
Area in fruit	43.22	38.52	41.3	36.8
Area in general farm crops	61.45	66.18	58.7	63.2
Total	104.67	104.70	100	100
Pasture, roads, and farmstead	17.63	17.60	.....	.....
Total farm area	122.30	122.30	.....	.....

MANAGEMENT OF THE FARM.

The farm studied is a typical western New York farm on which fruit is the foremost of the enterprises. Of the total area, 50 per cent is devoted to general farm crops other than fruit. It is the plan to raise enough hay, oats, and corn for feed. Potatoes are raised only for home use. Besides fruit, wheat and beans are the cash crops. Each year 20 or 30 sheep are kept and pastured during the summer. Lambs are raised and fattened during the early spring

months. Six horses are kept for work and one for family use. One or two colts are raised each year.

The organization of any farm of this type will have more or less bearing on the method of management of the orchard and will therefore have its influence on the cost of producing fruit. There will be more or less variation, whether it is a general farm with fruit as one of the enterprises or a specialized fruit farm.

The apple orchard, consisting of 14.74 acres, is situated in the northwestern part of the farm. There are 527 trees of bearing age,

FIG. 2.—View in the Wellman orchard, showing the size and shape of the trees.

45 to 65 years old, consisting mainly of Baldwins and Rhode Island Greenings.

The soil here is a medium clay loam about 10 inches deep, with a subsoil of heavy clay. The orchard has a slight northerly slope, and the drainage is good.

HISTORY OF THE ORCHARD.

In 1864, at the time Mr. I. E. Wellman took possession of the farm, there were 100 Baldwin trees about 20 years old. In 1866, 150 Baldwin and Fall Pippin trees were set out, and in 1871 the remainder of the orchard was set to Baldwin and Rhode Island Greening trees. These trees were set 33 by 33 feet on the square. The orchard as it now appears is shown in figure 2.

EARLY TREATMENT OF THE ORCHARD.

Up to the time that the orchard came into bearing it was cropped with a rotation of beans, barley, wheat, and clover. When the trees came into bearing, the orchard was allowed to remain in sod and was used mainly for a cattle and sheep pasture. Owing to the low returns, orchards in western New York were cut down to a great extent about 1893, and at that time land on which apple trees stood was assessed for little or nothing. But on this specific farm in 1894 greater care was taken to make the orchard produce more, and in 1896 it bore its heaviest crop, like many orchards in the region. In 1897 the orchard was plowed and cultivated. This was the beginning of an organized effort to make the orchard profitable. Since that date greater care in pruning, spraying, and cultivation has been given.

CULTURE SINCE 1907.

In the spring of 1907 the entire orchard was plowed 3½ inches deep. During that season it was harrowed five times, and a cover crop of clover, 6 quarts of seed to the acre, was sown the latter part of July. In 1908 the orchard was left in sod. In 1909 a double-action disk was used to break up the sod. This was followed by a spring-tooth harrow during the summer, and in the month of July the orchard was again sown to clover. It was mowed in 1910, and in 1911 the soil was plowed away from the trees. During the summer the orchard was cultivated five times and sown to clover in the latter part of July.

In 1912 there was an excellent clover sod, but during the month of August the army worms appeared in great numbers, eating the clover to the ground and giving the remaining cover the appearance of having been swept by fire.

RATES PAID FOR LABOR.

The rates of labor used in showing the costs of the orchard operations are the same as those of the other enterprises on the farm, such as the growing of beans, wheat, and hay. The cost per hour of man labor was 17.9 cents, and the cost per hour of horse labor was 15.3 cents. These rates represent the total cost of paid labor plus the value of board and privileges. The proprietor's labor was considered at the same rate as that of the regular workmen on the farm.

In the case of horses, a cost of $10 per month, or $120 a year, was used. This amount, divided by the total number of hours worked by the horses, gave an hourly cost of 15.3 cents. The rate of both man and horse labor was lessened by reason of the general farm crops, which utilized the labor when not needed for the fruit.

LABOR COSTS FOR VARIOUS OPERATIONS.

Three cost factors present themselves in any business enterprise. In this bulletin these are termed labor, cash, and fixed costs.

In considering the labor requirements in the production of fruit, the following questions present themselves: What operations make the total labor in the production of marketable apples? What factors influence the cost of these operations? What records should be kept by the grower so that he may at any time know the cost of a given operation and at the close of any season know the total cost of any and all operations?

In the management of commercial orchards there are operations which must be performed and which are essential for the production of marketable fruit. These operations will be discussed in the order of their occurrence in the western New York apple belt.

Detailed labor costs for the Wellman farm, taken during 1911 and 1912, are given in Table II.

TABLE II.—*Labor costs on the 14.74-acre Wellman apple orchard, containing 527 trees, for 1911 and 1912.*

Operations.	Dates.	Total hours.		Labor cost.			
		Man.[1]	Horse.[2]	Total.	Per acre.	Per tree.	Per barrel.
	1911.						
Pruning	Mar. 11 to Apr. 17	137		$24.52	$1.663	$0.046	$0.026
Removing brush	Apr. 10 to 26	27½	26	8.90	.604	.017	.009
Mixing lime and sulphur		8		1.43	.097	.003	.002
First spraying	Apr. 25 to May 2	49¼	38½	14.70	.998	.028	.016
Second spraying	May 12 to 13	45	30	12.65	.859	.024	.014
Third spraying	May 23 to 26	48½	48	16.03	1.088	.032	.017
Plowing	June 18 to 27	101¾	193½	47.81	3.243	.091	.051
Rolling	May 29 to June 7	10½	21	5.09	.344	.010	.006
First harrowing [3]	June 7 to 8	30½	61	14.79	1.004	.028	.016
Second harrowing	June 19 to 22	12¼	24½	5.94	.403	.011	.006
Third harrowing	June 30 to July 22	10	20	4.85	.329	.009	.005
Fourth spraying	July 20 to 21	24	24	7.97	.541	.015	.009
Sowing cover crop	July 22 to 24	10½		1.88	.128	.004	.002
Fourth harrowing	July 22 to 25	24¾	49½	12.01	.814	.023	.013
Picking apples	Aug. 31 to Oct. 19	765½		137.03	9.297	.260	.146
Picking up apples	Sept. 21 to Oct. 22	100¾		18.04	1.224	.034	.019
Packing apples	Aug. 31 to Nov. 3	418½		74.91	5.082	.140	.080
Marketing apples		234½	355½	96.36	6.536	.183	.102
Total for year		2,058¾	891½	504.91	34.254	.958	.539
	1912.						
Pruning	Dec. 21 (1911) to Apr. 26	229¼		41.03	2.784	.078	.019
Removing brush	Apr. 4 to May 3	74¼	60½	22.55	1.530	.043	.011
First spraying	May 3 to 4	55½	36	15.44	1.048	.029	.007
Second spraying	May 13 to 14	45½	30	12.73	.864	.024	.006
Third spraying	May 31 to June 6	80	54	22.58	1.532	.043	.011
Cutting clover	June 25 to July 11	13	26	6.31	.428	.012	.003
Cutting clover (with scythe)	June 28 to July 11	11		1.97	.133	.004	.001
Fourth spraying	Aug. 6 to 13	67¾	70	22.84	1.550	.043	.011
Thinning apples	Aug. 7 to 13	34		6.09	.413	.012	.003
Cutting blight	Aug. 16 to 29	22		3.94	.267	.007	.002
Picking apples	Aug. 26 to Oct. 31	239					
Contract picking	Oct. 9 to 31	553¾					
Total picking		792¾		319.48	21.674	.606	.152
Packing apples	Aug. 28 to Nov. 21	959		171.66	11.645	.325	.081
Hauling apples to barn	Sept. 28 to Oct. 31	137¾	124½	43.71	2.965	.083	.021
Marketing barreled apples	Aug. 26 to Nov. 21	193¾	383	93.28	6.329	.177	.044
Marketing driers	Oct. 2 to Dec. 4	84¼	168½	40.86	2.772	.077	.019
Picking up apples	Oct. 31 to Dec. 3	125½		22.46	1.524	.043	.011
Equipment to and from orchard		4	8	1.94	.132	.004	.001
Inspection		9½		1.70	.115	.003	.001
Superintendence		34		6.09	.413	.012	.003
Total for year		3,062¾	960½	856.66	58.118	1.625	.407

[1] Man-hour rate, 17.9 cents.
[2] Horse-hour rate, 15.3 cents.
[3] Ground harrowed over twice. A 3-section spike-tooth harrow was used first, followed by a spring-tooth drag.

PRUNING.

Pruning is done during the dormant season, i. e., in the winter and early spring, when weather conditions are favorable. Many factors have their influence on the cost of this operation. The most important of these are the variety, age, and size of the trees, their characteristic growth, physical condition, distance apart, the style of pruning adopted by the grower, and, lastly, of greatest importance is the expertness of the operator.

In the orchard considered, between 20 and 25 trees are trimmed in a 10-hour day. Attention is annually given to each tree, which is pruned for an open head and cut well back, so that there will be sufficient space for sunlight and air. All dead wood and interfering branches are removed. It is the practice to thin out along the main branches rather than to cut out the large limbs. These large limbs, when cut, are trimmed up in the orchard and hauled to the house for firewood. In all cases, care is taken to prune so that the spray material may be thoroughly applied and picking may be done to the best advantage. The cost of pruning in this orchard in 1912 was 8 cents per tree.

SPRAYING.

Most western New York apple growers spray at least three times. Some spray as many as six times.

The gasoline power sprayer is most commonly used among the growers in this section, although hand outfits and a few steam engines are now and then found in use. A complete up-to-date gasoline engine, pump, tank, and truck cost from $200 to $350, depending upon the make and the horsepower of the engine. The cost of the operation will vary each year, being influenced largely by the number of sprayings.

The first application of spray is usually made when the trees are dormant, a second when the buds are pink, a third at the time the petals fall, and a fourth the latter part of July or the first part of August.

Numerous factors influence the cost of spraying. The variety and size of the trees and their distance apart have an influence on the time required for the spraying operation.

The amount of spray material used, as well as the thoroughness with which it is applied, depends upon whether the trees are dormant or partly or wholly in foliage. The condition and kind of material used will also affect the amount of labor needed.

Insect pests and diseases are sometimes more prevalent in one season than in another, and often some orchards are affected while others are not. The size and expertness of the crew used in spraying are factors to be carefully considered. The kind of spray outfit, together with its accessories, affects the cost of the operation. The

efficiency of an outfit can be increased by the use of horses which are accustomed to the hauling of a sprayer. Long distance from water and spray materials causes the loss of considerable time, which could often be remedied with practically little outlay.

Figure 3 shows a spraying crew at work in the Wellman orchard.

Table III gives a summary of the spraying costs per acre, per tree, and per barrel of marketable fruit. In 1911 and in 1912 the orchard was sprayed four times. The first spraying was done at the time the fruit buds were showing a little green color, the second time when the fruit buds were pink, the third after two-thirds of the petals had

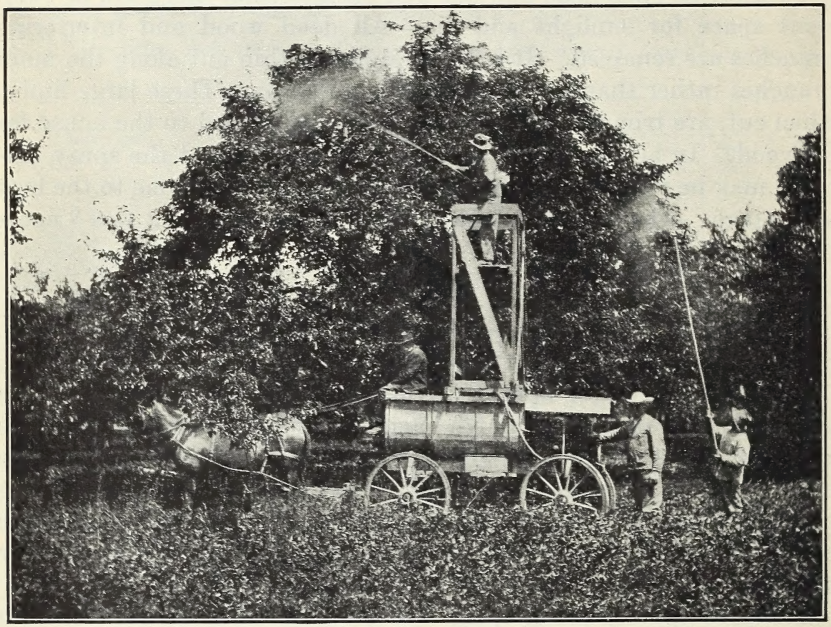

FIG. 3.—Power sprayer and crew. Two or three men are ordinarily used on the Wellman farm.

fallen, and the fourth the latter part of July in 1911 and the first part of August in 1912. If the same quantity of material were used and the same care taken each year, the time required for the operation would be nearly the same year after year. Referring to the first spraying in 1911 and 1912 (Table III), the cost of spraying would have been about the same if it had not been for the increased cost of spray materials. It is true that there was an increase in the amount of labor, due to the necessity of more thorough spraying for the control of the green aphids, but had this not been required the costs per acre of the 1911 and 1912 sprayings would have been approximately the same.

In the third and fourth sprayings of 1911 only the trees which blossomed were sprayed. This partly accounts for the lessened cost at those times.

TABLE III.—*Cost of spraying the 14.74-acre Wellman apple orchard, containing 527 trees from 45 to 60 years of age, in 1911 and 1912.*

Year and operation.	Hours per acre.		Cost per acre.			Cost of both material and labor.	
	Man.	Horse.	Labor.	Material.	Total.	Per tree.	Per barrel.
1911.							
First spraying	3.34	2.61	$0.998	$1.686	$2.684	$0.075	$0.042
Second spraying	3.05	2.03	.859	1.020	1.879	.053	.030
Third spraying	3.29	3.26	1.088	.765	1.853	.053	.029
Fourth spraying	1.63	1.63	.541	.358	.899	.025	.015
Total for season	11.31	9.53	3.486	3.829	7.315	.206	.116
1912.							
First spraying	3.76	2.44	1.048	.929	1.977	.055	.013
Second spraying	3.09	2.03	.864	.988	1.852	.052	.013
Third spraying	5.43	3.66	1.532	1.182	2.714	.076	.019
Fourth spraying	4.59	4.75	1.550	1.129	2.676	.074	.019
Total for season	16.87	12.88	4.994	4.228	9.219	.257	.064

TILLAGE.

There are many systems of orchard management in the apple belt of western New York. In the management of the Wellman orchard it has been the practice to plow 3½ to 4 inches deep in the spring. The ground is tilled during the season, and in the latter part of the summer a cover crop is sowed, the orchard remaining in sod the following year. With this plan of management the orchard is in sod every other year.

In 1911 this orchard was plowed. On the average, 1.5 acres were plowed each 10-hour day at a cost of $3.24 per acre. The depth of plowing, width of furrow, stiffness of sod, and the type of soil will influence the time required for this operation. Many times a single-horse plow is required to plow away from the trees. During the season the orchard was rolled once and harrowed five times. A cover crop was then sowed and the orchard again harrowed. The total labor cost of tillage was $6.26 per acre.

Figured on the basis of the yield in 1912, if the orchard had been plowed and worked during that year as in 1911 there would have been an increase of 4 cents per barrel in the labor cost. In addition, the cost of the cover crop would have been 2 cents per barrel, making a total increase of 6 cents per barrel in 1912.

If the plowing had been done in 1912, it would not have necessitated cutting the clover that year. This is a minor cost and would

make a difference of less than 1 cent per barrel. In the late summer of 1911, the year the orchard was plowed, a cover crop of oats, clover, and cowhorn turnips was sowed. There was an excellent growth of clover, and the latter part of the following June it was cut. Considering the total acreage of the orchard, only about one-half of it was cut with the mower, as it was impossible to get near the trees with the machine. It was the original plan to form a mulch with this clover and the crop which might have followed, but on account of the destructive work of the army worms this was not possible.

The exact proportion of bearing apple orchard and tillable cropping land which would make the use of labor most efficient is not known. It may not be possible to arrive at such a figure, but it is worth being considered by every grower of fruit.

A very important question arises in this connection: Can the specializing fruit grower produce, handle, and market his fruit for less than the general farmer who makes the growing of the apple one of his farm enterprises?

HANDLING THE CROP.

The handling of the apple crop in the apple belt of western New York is a serious problem with many growers. Labor requires a high wage, and at times it is difficult to get efficient help. Some growers near the cities are able to get a little experienced help at harvesting time. Tramp labor often proves efficient, and many growers depend upon it.

The men with large bearing orchards are most seriously affected. The men on the general farms have some advantages over those on specialized fruit farms. On the general farms labor is needed the entire year, and this labor is often sufficient for the apple harvest.

PICKING.

The method adopted in picking apples depends to some extent on the size of the crop. The cost of the operation is influenced by many factors, of which the expertness of the picker is perhaps the greatest. The variety and quality of the fruit, the time of picking, the quantity of fruit on the tree, the shape and height of the tree, and the equipment used in picking the fruit are other factors which materially affect the cost.

In 1911 regular labor and a small amount of extra labor were used to pick the marketable crop of 937 barrels. This was done at a cost of 15 cents per barrel. In 1912 the early apples, 284 barrels, together with 108 barrels of Baldwins, were picked by regular labor and a small amount of extra labor at a cost of 11 cents per barrel.

The marketable barreled Baldwin crop was picked by contract labor at a cost of 16 cents per barrel.

During the season 30 Baldwin trees were thinned. About half the fruit was removed when the size of walnuts at a cost of 20 cents per tree. At harvest time the same quantity of marketable apples was picked from these trees as from 30 Baldwin trees which were not thinned.

Table IV shows the number of barrels of Baldwin apples picked by contract labor in 1912, together with the cost of picking.

TABLE IV.—*Number of barrels of Baldwin apples and cost per barrel of picking by contract labor on the Wellman orchard in 1912.*

Pickers.	Rate to picker per barrel.	Number of barrels.[1]	Cost of picking.			Average number of barrels picked per day.	Cost per barrel.
			Cash.	Board.	Total.		
G. L.	$0.11	321					
Do	.12	123	$50.07	$13.50	$63.57	31.5	$0.143
B. W.	.12	74	8.88	2.25	11.13	24.7	.15
M. R.	.11	210					
Do	.12	84	33.18	14.25	47.43	18.1	.161
A. R.	.125	383					
Do	.135	144	67.32	3.80	71.12	31.5	.135
T. S.	.11	45	4.95	2.25	7.20	21.4	.16
H. L.	.11	105	11.55	5.25	16.80	16.4	.16
R. K.	.12	165	19.80	3.00	22.80	41.3	.138
C. M.	.12	225	27.00	4.20	31.20	28	.139
C.	.10	32	3.20	2.25	5.45	10.7	.17
Total		1,911	225.95	50.75	276.70		
Average	.118						.145

[1] Of 1,911 barrels picked by contract labor, 1,712 barrels were marketable. The average cost of picking the marketable barreled apples was 16 cents per barrel.

PACKING.

In 1911 the packing time was nearly equally divided between orchard and barn. The average cost of packing was 8 cents per barrel.

In 1912 the average cost of packing apples was 9 cents per barrel. An account was taken of the time actually spent in packing apples in the orchard and in the barn in 1912. There were 854 barrels packed in the orchard at a cost of 7.7 cents per barrel, while 1,250 barrels were packed in the barn at a cost of 13.2 cents per barrel. In considering the cost of packing in the barn the actual time charge would amount to 9.7 cents per barrel. The cost of hauling these apples to the barn was 3.5 cents per barrel, which is part of the packing cost.

MARKETING.

In 1911 the labor of hauling the dried and the barreled apples was combined, and therefore the cost of hauling the barreled apples to market can not be ascertained for that year. In 1912, however,

the apples were hauled 1.5 miles to storage, at a cost of 36 cents per ton per mile. The cost per barrel per mile was 3 cents.

On return trips from storage the driver passed near the barn, taking a load of empty barrels to the orchard. The time required for this operation was small and considered part of the marketing cost. At noon, on the way to dinner, a load of unsorted apples was usually hauled to the barn. Generally a load was hauled also at the close of the day. When the weather would not permit outside work, the apples were packed in the barn. This cost was considered under packing. Even though the cost of packing in the barn was higher, this was doubtless more than offset, as the help was able to work during bad weather.

The principal labor operations which were performed on this particular farm in order to produce marketable fruit have been described. There are many minor factors which would influence the cost of these operations. Definite figures which could be used universally can not be given. Each farm is a unit, and the several enterprises are managed differently on each farm. The figures presented are suggestive and illustrate the method used in arriving at the total labor cost of producing a marketable barrel of apples on the Wellman farm during the two years specified.

A summary is given in Table V of (1) the cost of operations up to picking time and (2) the cost of handling the crop. Although the 1912 crop was more than double that of 1911, the cost of handling it was only one-half a cent less per barrel. Up to picking time in both years the operating cost per tree was about the same.

TABLE V.—*Summary of labor costs on the 14.74-acre Wellman apple orchard, containing 527 trees, in 1911 and 1912.*

Item of cost.	1911		1912	
	Per tree.	Per barrel.	Per tree.	Per barrel.
Operations until picking time	$0.341	$0.192	$0.310	$0.078
Handling the crop	.617	.347	1.315	.329
Total	.958	.539	1.625	.407

CASH COSTS.

In the cost of the production of apples there are certain items for which a more or less direct outlay of cash, or its equivalent, is necessary. Such items as spray material, cover-crop seed, fertilizer, manure, barrels, storage, freight, etc., come under this head.

The manure cost is found by adding to the value of the manure the cost of applying it to the field. The total cost of the application

in any one year is commonly charged to that year and the two years following on the basis of 50, 30, and 20 per cent, respectively.

In the Wellman orchard these cash costs proved to be 45 cents per barrel in 1911 and 46 cents per barrel in 1912. Of these, the barrel cost is the major portion, being 31 cents in 1911 and 42 cents in 1912, or 69.7 per cent and 91.7 per cent, respectively, of all cash costs. The complete record of cash costs is given in Table VI.

No expense was incurred in 1912 for cover-crop seed, but this was more than offset by the increase in the cost of barrels.

TABLE VI.—*Cash costs on the 14.74-acre Wellman apple orchard, containing 527 trees, for 1911 and 1912.*

Year and item of cost.	Distribution of cost.				
	Spray.	Total.	Per acre.	Per tree.	Per barrel.
1911.					
Manure charge (50 per cent against 1911 apples)		$30.77	$2.087	$0.058	$0.033
Spray materials used:					
First spraying—					
Lime and sulphur, 40 gallons, at $0.04 [1]	$1.60				
Lime and sulphur, 100 gallons, at $0.16 [2]	16.00				
Tobacco extract, 3 pints, at $1.562	4.69	24.85	1.686	.047	.026
Lead arsenate, 32 pounds, at $0.08	2.56				
Second spraying—					
Lime and sulphur, 43 gallons, at $0.16	6.88				
Lead arsenate, 102 pounds, at $0.08	8.16	15.04	1.020	.029	.016
Third spraying—					
Lime and sulphur, 32 gallons, at $0.16	5.12				
Lead arsenate, 77 pounds, at $0.08	6.16	11.28	.765	.021	.012
Fourth spraying—					
Lime and sulphur, 15 gallons, at $0.16	2.40				
Lead arsenate, 36 pounds, at $0.08	2.88	5.28	.358	.010	.006
Barrels, 937, at $0.311		291.41	19.770	.553	.311
Seed for cover crop [3]		39.47	2.678	.075	.042
Total for season		418.10	28.364	.793	.446
1912.					
Manure charge (30 per cent against 1912 apples)		18.46	1.252	.035	.009
Spray materials used:					
First spraying—					
Lime and sulphur, 80 gallons, at $0.04 [1]	3.20				
Lime and sulphur, 75 gallons, at $0.14 [2]	10.50	13.70	.929	.026	.006
Second spraying—					
Lime and sulphur, 44 gallons, at $0.14	6.16				
Lead arsenate, 105 pounds, at $0.08	8.40	14.56	.988	.028	.007
Third spraying—					
Lime and sulphur, 52.5 gallons, at $0.14	7.35				
Lead arsenate, 126 pounds, at $0.08	10.08	17.43	1.182	.033	.008
Fourth spraying—					
Lime and sulphur, 35 gallons, at $0.14	4.90				
Lead arsenate, 146.75 pounds, at $0.08	11.74	16.64	1.129	.031	.008
Barrels, 2,104, at $0.421		885.78	60.094	1.681	.421
Total for season		966.57	65.574	1.834	.459

[1] Undiluted homemade solution: 36 pounds of lime, 80 pounds of sulphur, and 50 gallons of water. The cost of labor is included. Rate of dilution, 1 gallon of lime and sulphur solution to 7 gallons of water.

[2] Undiluted commercial lime and sulphur: Rate of dilution, 1 gallon of lime and sulphur solution to 10 gallons of water.

[3] Items of seed cost: Clover, 180 pounds, at 16 cents; oats, 22 bushels, at 40 cents; turnips, 7.5 pounds, at 25 cents.

FIXED COSTS.

The term "fixed costs" embraces all costs other than labor and cash costs that enter into and make up the total cost of production. Although these costs are indirect, they must be given due consideration before the total cost can be determined. Under this group are such items as interest and taxes on real estate, the cost of the use of machinery and use of buildings, and overhead expense. These fixed costs for the Wellman orchard for 1911 and 1912 are given in Table VII.

TABLE VII.—*Fixed costs on the 14.74-acre Wellman apple orchard, containing 527 trees, for 1911 and 1912.*

Item of cost.	Distribution of cost, 1911.				Distribution of cost, 1912.			
	Total.	Per acre.	Per tree.	Per barrel.	Total.	Per acre.	Per tree.	Per barrel.
Use of machinery [1]	$31.68	$2.149	$0.060	$0.034	$31.68	$2.149	$0.060	$0.015
Land rental (interest and taxes 5.905 per cent)	241.04	16.353	.457	.257	241.04	16.353	.457	.115
Overhead expense	22.19	1.505	.042	.024	29.74	2.018	.057	.014
Total fixed costs for season	294.91	20.007	.559	.315	302.46	20.520	.574	.144

[1] The machinery included here is used on several orchards on this farm, and the charge here shown is the pro rata share for this orchard, being about one-third of the total amount.

In the Wellman orchard these costs amounted to 31.5 cents per barrel in 1911 and 14.4 cents per barrel in 1912. As the total of these costs varies but little from year to year for the same orchard, the cost per barrel is directly proportionate to the yield.

The major portion of the fixed costs is in the interest on the investment and the taxes on the land. The land rental is figured at 5 per cent on the estimated inventory value of the orchard, plus the taxes, which amounted to 0.905 per cent on this same value. In 1911 this land rental was 81.8 per cent of the fixed costs and in 1912, 80 per cent.

No account has been taken of the depreciation of the orchard. This factor will depend largely on the variety of apples grown, the age of the trees, the soil and climate, and the cultural methods adopted. The presence of insect pests and fungous diseases and the thoroughness of their control will have their influence on the life of the orchard. Owing to insufficient data, no attempt is made to measure this item of cost. Nevertheless, it should be borne in mind by apple growers.

SUMMARY.

In Table VIII all the costs of operation are summarized for both the years specified. On this particular farm these show a total of $1.30 per barrel of marketable apples for 1911 and $1.01 for 1912.

The three most important items constituting this cost are labor, amounting to 40 per cent; the package (barrel), from 25 to 41 per cent; and the land rental, from 12 to 20 per cent. There are many other items, but these three constitute from 85 to 90 per cent of the total cost per barrel of marketable apples. Many growers do not realize that the money paid out for barrels alone is often more than the entire labor cost of production.

TABLE VIII.—*Summary of labor, cash, and fixed costs on the 14.74-acre Wellman apple orchard, containing 527 trees, for 1911 and 1912.*

Item of cost.	Distribution of costs, 1911.				Distribution of costs, 1912.			
	Total.	Per acre.	Per tree.	Per barrel.	Total.	Per acre.	Per tree.	Per barrel.
Labor	$504.91	$34.254	$0.958	$0.539	$856.66	$58.118	$1.625	$0.407
Cash	418.10	28.364	.793	.446	966.57	65.574	1.834	.459
Fixed cost	294.91	20.007	.559	.315	302.46	20.520	.574	.144
Total	1,217.92	82.625	2.310	1.300	2,125.69	144.212	4.033	1.010

In this connection it must be remembered that these figures refer only to the Wellman farm and are merely for the two years considered. They may or may not apply to any other farm in this same community. All fruit growers realize the wide variation in the important factors related to the cost of growing apples and the need for a careful consideration of these in any study of this problem. These factors will vary in respect to variety, age, and size of trees, soil, climate, method of management, and particularly in respect to the ability of the farmer as a manager. In further consideration of these figures it should be kept in mind that the data here presented pertain to an orchard that is over 50 years old and is well located for the production of good fruit.

Referring again to Table VIII, it will be noted that the cost per acre and per tree was much greater in 1912, yet the larger yield of apples made the cost per barrel 28 cents less than that of the preceding year. As regards fixed costs, they are fairly constant, being approximately $20 a year per acre on this particular orchard. The cash costs—that is, such expenses as spray materials and barrels—are largely dependent upon the amount and price of spray material, together with the number of barrels or other packages used. Hence, these items of expense will vary with the yield of marketable fruit.

The labor cost is influenced by the method of management. It is in this connection that the efficient organization of the entire farm, of which the orchard forms only one part, becomes an important factor in lessening the rate of both man and horse labor. On a farm where the apple orchard constitutes the only enterprise, there being no other source of farm income, it is evident that all the labor expended

must be charged against the apple orchard. Hence, it is quite possible that the rate per hour of man and horse labor would be much higher than on a well-diversified farm, where the labor is better distributed throughout the year. The lowering of this rate on a diversified farm comes about through the other farm enterprises utilizing the labor during the periods when it is not needed in orchard work.

Persons taking up fruit growing as a specialty without any other sources of farm income are not following the experience of the best growers in the oldest apple-producing regions of this country. The Wellman farm is an excellent illustration of growing fruit in connection with other farm crops. The crops, such as beans, wheat, and hay, form no small part in lessening the operating costs of this orchard, in that fruit growing constitutes only one item of the farm business. In this way the overhead costs chargeable to the orchard are materially decreased, while in the case of the specialized apple farm all such costs must be borne entirely by the orchard. The reader is urged to bear in mind that the data which have been presented refer only to a particular orchard on a single farm and give only the expense factors incident to the maintenance and operation of this well-cared-for mature orchard. This publication is intended to illustrate a method which, if followed by apple growers, will enable them to analyze the important factors entering into the cost of operating and maintaining their orchard industries and to determine the relation which the various cost factors bear to one another in years of varying crop production. By adopting this method the independent grower will be able to determine the actual cost of maintaining and operating his fruit enterprise on his own farm.

No intelligent grower will assume that these figures are actual costs on his own farm, but he should determine for himself the cost of producing his fruit.

Apple growing as a commercial business has in many regions reached a high state of development. With the increased development keener competition will result. In order to realize profits, the producer must manage his business efficiently. The men most favorably situated and who are experienced and efficient will be able to produce apples cheapest. The lessening of the cost will not necessarily be due to differences in cultural methods, the reduction of package costs, or the decrease in the wages of the help, but to better management of the farm as a unit.

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